COCOA POD BORER

IMPORTANCE

Cocoa pod borer (CPB) causes losses to cocoa by boring through the wall and into the pod, feeding on the pulp of bean and placenta of the pod. Damage to the funicles of pods results in malformed and undersized beans, in severe infestation it produce small flat beans that are often stuck together. It also causes the pod to yellow or ripen unevenly and prematurely. The beans from seriously infested pods are completely unusable, and over half the potential crop can be lost in heavy infestations. In light infestations, there may be no economic loss but control is still needed to prevent the development of more serious infestations.

Live pod borers are tough and can disperse over long distances. The CPB is also a pest of rambutan.

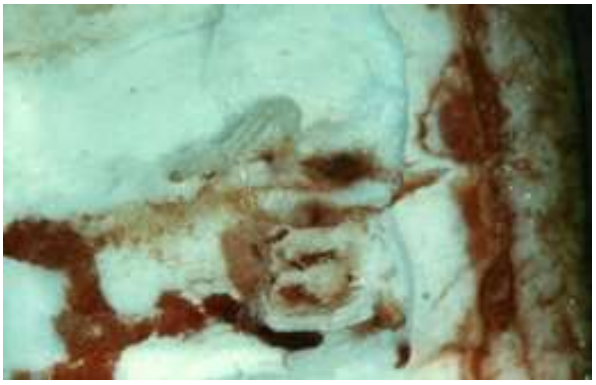
PEST DESCRIPTION

Eggs

The CPB lays tiny yellow-orange eggs. It is oval based and disk-like shape eggs. The eggs can be seen with the naked eye and measure about 0.5 x 0.2mm in size. There are mosaic pattern on the egg surface. The eggs are laid singly anywhere on the pod surface although there appears to be some preference for the pod furrows. On hatching (six to nine days), eggs become translucent, the shell being whitish but darkened inside by faeces.

Larvae

On hatching, the first larva stage (instar) is translucent white in colour and about 1 mm long. It tunnels through the floor of the eggshell and burrows into the husk. The larva tunnels in any direction inside the pod and feeds randomly. In younger pods, early-instar larvae can penetrate the developing beans, causing misshapen and undersized beans.



Pupae

The feeding activity of the CPB larvae results in the pre-mature ripening of the cocoa pods. This often causes confusion on ripeness standards for harvesting.

Late larva stages are about 1 cm long and creamy coloured while still inside the pod, but greenish after they emerge to pupate. Once outside the pod, larvae crawl or lower themselves by a silk thread to a suitable site for pupation.

The pupation site could be in a furrow of the pod, or green dried leaves and other debris. Once the larvae have identified the pupation sites, they spin oval-shaped cocoons and enter a short prepupal stage before forming pupae.

The pupa is recognisable as an encasing of a light-brown waterproof silken membrane tightly drawn over a depression on a pod surface or leaf.

Adult

The adult is a small brown moth, about 7 mm in length. It has a wingspan of about 12 mm and has bright yellow patches at the tips of the forewings. The moths have very long antennae, which are swept backwards in their natural resting position. In flight the moths look like large, slow-flying mosquitoes.

ECOLOGY

Eggs are laid on pods more than 5 cm in length. The entire larval stage takes 14-18 days to complete, with 4-6 instars. The great majority of the larvae emerge from pre-maturely ripened cocoa pods. The larvae then tunnel out through the pod wall, leaving an easily identifiable exit hole.

The pupal stage normally takes 6-8 days to complete. The pest is therefore most likely to be transported by man to other cocoa-growing areas through movement of pods, leaves and other objects in or to which larvae and pupae are attached.

The moths are most active at night; mating and egg-laying takes place at this time. A female can normally produce 50-100 eggs in her lifetime. The moths are not known to fly long distances, and long-distance movement of CPB must almost certainly take place through movement of infested pods.

During the day, adult moths normally rest underneath horizontal or near-horizontal cocoa branches. The adult has a protective coloration that blends with the resting place making them difficult to spot. Adult longevity is generally about one week, but they can live up to 30 days. In total, the entire life cycle takes about 1 month to complete.

MANAGEMENT

Regular and complete harvest (*Rampassen*)
In the early days of the 20th century, regular and complete harvesting, or *rampassen*, was considered to be the only feasible control method. Research on the life cycle and oviposition habits of pod borer in the early 1980s confirmed that removing all pods longer than 6-7 cm from a field for 6 weeks would break the life cycle of the insect, as female moths will not usually lay eggs on younger pods. The main setback for *rampassen* is the migration of female moths from uncontrolled cocoa farms, unless communal action is taken. Also, without appropriate pruning, complete elimination of a population of pod borer through *rampassen* is difficult.

If pods are picked at the earliest stage of ripeness, then almost 90% of the larvae will still be inside the pods. If pods are broken quickly and the husks destroyed, buried or covered with transparent plastic, the larval death rate will be very high and a good degree of control can be achieved. Alternatively, unbroken pods can be kept in plastic bags for several days, either to contain emerging larvae or to kill them through over-heating inside the bag. The interval between harvesting should be 14 days or less. An alternative would be to abandon harvesting during the low crop, and at the first sign of the rising crop to begin very intensive complete harvesting for several months. The economic implications of both alternatives would need to be tested in farmer trials.

Mechanical Control
In pod borer infested areas in the southern Philippines, some cocoa has been planted at very high densities as hedges with access for small tractors between pairs of rows. Trees are kept to a low height so that all harvesting can be done within easy reach. Mechanisation allows frequent, regular harvesting, and the hedge-like structure of the crop (1-m squares within the double rows, and 2-3 m between rows for mini-tractor access) allows thorough complete harvesting. Under this system, infestations of pod borer were at insignificant levels during the late 1980s, without any other form of control.

The idea of sleeving pods with bags of plastic or other materials to prevent egg-laying originated in Indonesia. Thin plastic bags, with open bottoms for ventilation, are placed on very young pods (less than 7 cm long) and left throughout the pod maturation period result in virtually complete protection from pod borers. The main problems are that bags are sometimes placed too late, or that insufficient ventilation may result in rots. In addition, this method is labour intensive. The economics of this method will depend on cost of labour versus cocoa yields.

Biological Control

Ant species, the large black ant (*Dolichoderus* sp.) and the weaver ant (*Oecophylla smaragdina*) are known to prey on larvae at emergence from the pods and on pupae, and disturb adults. However the best predator ant was actually the small 'sugar' ants (*Iridomyrmex* spp.) Predation by ants is almost a constant 40% of pupae each month. Ants can be augmented and manipulated to colonise areas within a cocoa garden. However, this needs care and patience to get it right.

Mass rearing and release of parasitic wasps has been tried. *Trichogrammatoidea* sp. gave good levels of control. *Ceraphron* and *Ooencyrtus* species were also tried but the cost was prohibitive. None of these parasitic wasps have established themselves successfully enough to be more than good local control agents.

The fungus *Beauveria bassiana* has been used very effectively to control larvae. Larvae that were infected on emergence from pods died during pupation. Other fungi have also been used very successfully. However, these compounds are difficult to find, as they are not usually commercially produced.

Chemical Control

Blanket spraying is not effective in the long term as populations of other pests, that are not normally a problem, can explode. Chemical sprays are subject to strict regulation for suitability, safety of the operator, and safety for the environment. The use of chemicals is not permitted in organic cocoa farming.

INTEGRATED PEST MANAGEMENT

The most immediate reductions in cocoa pod borer are likely to come about through integration of cultural control, viz. *rampassen*, and rational pesticide use. Both of these rely on well-pruned trees kept to a height low enough to collect and/or spray all pods. Longer-term control may be improved by grafting or replanting with hard-walled clones. Further releases of exotic natural enemies may provide additional partial control, if suitable parasites can be found.

CROP LOSSES

Over half of a crop can be lost due to heavy infestation.

PREFFERED SCIENTIFIC NAME

Conopomorpha cramerella Snellen

TAXONOMIC POSITION

Domain: Eukaryota

Kingdom: Metazoa

Phylum: Arthropoda

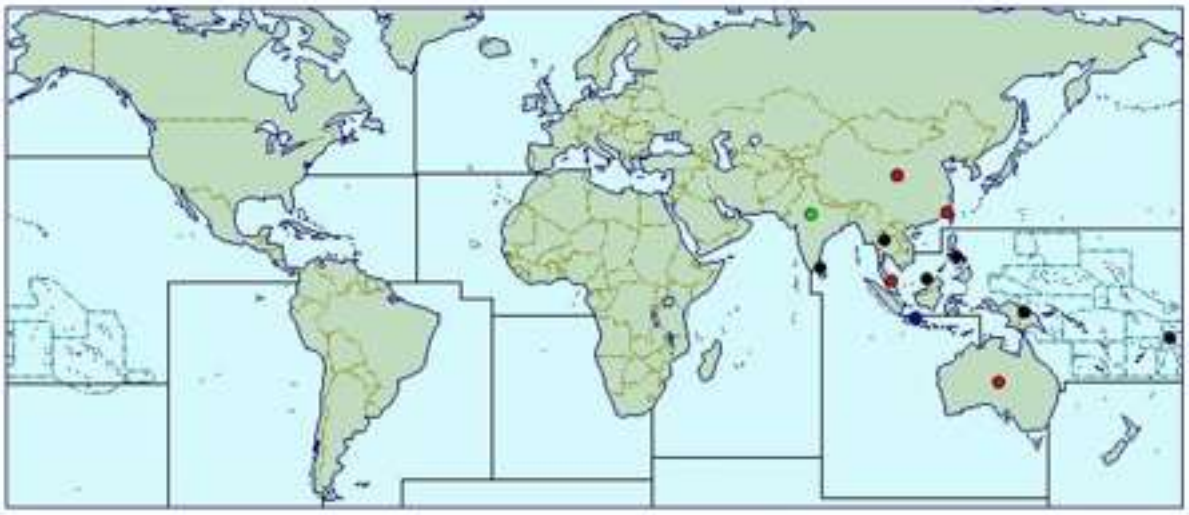
Subphylum: Uniramia

Class: Insecta

Order: Lepidoptera

Family: Gracillariidae

DISTRIBUTION MAP



● = Present, no further details ● = Widespread ● = Localised
● = Confined and subject to quarantine ○ = Occasional or few reports
● = See regional map for distribution within the country

Crop Protection Compendium 19/03/2014